

# 2020 Post-Enumeration Survey Initial Housing Unit Followup Operational Assessment

*A New Design for the 21st Century*

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## Executive Summary

The purpose of the 2020 Post-Enumeration Survey (PES) was to measure the coverage of the 2020 Census. The PES was designed to measure the coverage of housing units and people—excluding group quarters, people residing in group quarters, and remote areas of Alaska. The PES provided estimates of net coverage and components of coverage including correct enumerations, erroneous enumerations, whole-person census imputations, and omissions.

The 2020 Initial Housing Unit Followup (IHUFU) operation was the second PES field operation conducted. It included the IHUFU production, conducted from July 30, 2020, to September 25, 2020, and the IHUFU Quality Control (QC), conducted from August 6, 2020, to September 25, 2020. The COVID-19 pandemic caused a delay of about three months to the start and finish of the IHUFU and IHUFU QC. In the IHUFU operation, addresses that met predetermined criteria from the Independent Listing (IL) operation and the preliminary census address list were followed up in the field to collect additional information to determine their unit status, match status, or both.

Prior to the start of IHUFU, Initial Housing Unit (IHU) computer and clerical matching occurred. During IHU computer matching, the PES IL addresses were computer matched against the census addresses within each sample basic collection unit (BCU) and one ring of BCUs surrounding each sample BCU. Addresses in each PES sample BCU were assigned an outcome code of matched, possibly matched, or nonmatched. Potential duplicates were also identified during computer matching. In general, the matched addresses, possibly matched addresses, nonmatched addresses, and potential duplicates were sent to IHU Before Followup clerical matching for matchers to confirm and resolve. BCUs with unresolved addresses were sent to IHUFU.

During IHUFU, field staff, referred to as IHUFU listers, used follow-up paper forms to collect the necessary information. All follow-up cases in a BCU were grouped into a single IHUFU packet. An IHUFU case included an IL address with up to two duplicates, a census address with up to two duplicates, or a matched or possibly matched pair of IL and census addresses with up to two duplicates each. The questions included for each IHUFU case varied depending on the reason the case was sent to the field for follow-up. The follow-up forms were customized for each individual situation, resulting in many different IHUFU form types.

Procedural changes were implemented in response to the COVID-19 pandemic to minimize contact at the follow-up addresses. IHUFU listers were allowed to complete the IHUFU forms by observation first before attempting to interview by telephone or by a personal visit. When an address could not be confirmed by observation, a mailed letter provided a phone number for the respondent to call the IHUFU lister and set up a telephone interview.

The COVID-19 pandemic also affected the IHU Before Followup clerical matching activities.

Because of stay-at-home orders and requirements for social distancing in census facilities, IHU Before Followup clerical matching was scaled back and IHU computer matching determined the majority of addresses requiring follow-up. Puerto Rico BCUs were not worked in IHU Before Followup clerical matching, but instead went straight to IHUFU from IHU computer matching. Ultimately, these changes resulted in a higher IHUFU workload.

During IHUFU QC, a check was performed on a random sample of each IHUFU lister's work in each BCU. All BCUs with addresses that needed to be followed up in IHUFU had at least one production case selected for QC. During the QC check, the QC lister dependently verified the completeness and accuracy of the IHUFU lister's work. If a BCU failed the QC check, the QC lister dependently verified the remaining work of that IHUFU lister in that BCU and corrected any errors detected.

## **Results and Conclusions**

The IHUFU production workload consisted of 7,400 BCUs located stateside (that is, the 50 states and the District of Columbia) and Puerto Rico. In these BCUs there were 345,000 addresses requiring follow-up: 133,000 (38.6 percent) were IL addresses, 181,000 (52.5 percent) were census addresses in the sample BCUs, 30,500 (8.8 percent) were census addresses in a surrounding BCU, and 200 (0.1 percent) were census group quarters in the sample BCUs.

There were over 30 IHUFU case form types used. Five form types accounted for 95.5 percent of all forms generated for IHUFU. These top-five form types included the following follow-up reasons: a census address that did not have a link to an IL address, an IL address that did not have a link to a census address, possible match between an IL address and a census address, an IL address matched to a census address located in a surrounding BCU, and an IL address matched to a census address with one census duplicate address.

Of the 7,400 BCUs checked during IHUFU QC, 5,900 BCUs (79.7 percent) passed the QC check. If a BCU failed the QC check, the QC lister dependently verified all the remaining IHUFU case forms in that BCU.

There were 2,300 total field staff planned for the IHUFU operation (production and QC), but 4,100 were hired and trained, which was 178.3 percent of the planned total.

The IHUFU operation was estimated to cost \$6,496,126 for IHUFU production and \$1,749,212 for IHUFU QC, excluding training. IHUFU production was under budget by \$1,975,239 while IHUFU QC was over budget by \$611,574. The changes in field procedures for IHUFU production because of the COVID-19 pandemic, such as allowing addresses to be completed by observation first, likely led to shorter interviews and less visits allowing IHUFU to remain under budget. The IHUFU QC total cost was \$2,360,786 (35.0 percent) over the budgeted cost. The IHUFU QC operation overspent in the lister position by \$4,101 and overspent in the CFS position by

\$607,473. IHUFU QC field procedures were not affected by COVID-19, so the higher-than-expected IHUFU QC workload caused IHUFU QC to be over budget.

Of the 213,048 budgeted fieldwork hours, only 137,746 hours were needed to complete the IHUFU production. IHUFU QC needed 8,847 more fieldwork hours than the budgeted amount of 51,331 hours.

The IHUFU production rate was defined as the effort required to complete a single IHUFU case in terms of fieldwork hours. The actual production rate for IHUFU production was 2.0 cases per hour, which was more than twice the budgeted production rate of 0.9 cases per hour. The actual production rate of IHUFU QC was 0.7 cases per hour compared to the budgeted 0.5 cases per hour. The changes in field procedures because of the COVID-19 pandemic, such as allowing addresses to be completed by observation first, likely led to shorter interviews.

## Recommendations

Based on the goals and scope of the 2020 IHUFU operation, high-level recommendations for the 2030 PES are:

1. **IHUFU should use an automated instrument for data collection.** Listers felt the amount of paper materials needed during the operation was too cumbersome. The logistics needed to move the paper forms around in the field and at the National Processing Center (NPC) were complicated and time consuming.
2. **Electronic maps should be used for IHUFU instead of paper maps.** Paper maps proved difficult to use. The similar appearance of the various types of maps caused confusion and improper usage among the listers. Electronic maps would be more manageable in the field.
3. **Training should be updated with more interactive elements and focus on actual daily duties of field staff.** This includes role play exercises and practice cases with various field scenarios (such as how to work multiunits or unlocatable units, or how to use maps), alongside videos of cases being worked. Additional training on maps and map spotting as well as QC training on pass, fails, and critical errors would be beneficial. Field staff expressed that online training alone was not effective enough in preparing them for fieldwork.
4. **Regional census centers (RCCs) requested that for future operations, the IHUFU production and QC be considered as separate operations in the operations control system used in the field, as tracking BCUs' status between IHUFU production and QC was difficult when these were considered as one operation.**

## 1. Introduction

The purpose of the 2020 Post-Enumeration Survey (PES) was to measure the coverage of the 2020 Census. The PES was designed to measure the coverage of housing units and people—excluding group quarters, people residing in group quarters, and remote areas of Alaska. The PES provided estimates of net coverage and components of coverage including correct enumerations, erroneous enumerations, whole-person census imputations, and omissions. Since the PES was an evaluation, the results did not affect the 2020 Census results.

This assessment report focuses on the Initial Housing Unit Followup (IHUFU) operation only. Other PES data collection and matching operations are addressed in separate reports. This assessment describes what happened during the IHUFU operation and identifies lessons learned. It produces valuable data for the 2030 PES planning cycle and provides information on the success and shortcomings of the 2020 PES operations.

### 1.1 Initial Housing Unit Followup Operational Overview

Prior to the start of IHUFU, Initial Housing Unit (IHU) computer and clerical matching occurred. During IHU computer matching, the PES Independent Listing (IL) addresses were computer matched against the preliminary census address list<sup>1</sup> within each sample basic collection unit (BCU) and one ring of surrounding BCUs. See McGinnis et al. (Forthcoming) for more details on the IHU Matching operation. The sample BCUs were located stateside (the 50 states and the District of Columbia) and Puerto Rico, that were not in the remote areas of Alaska and not fully covered by water.

Addresses in each PES sample BCU were assigned one of three possible outcome codes during computer matching: matched, possibly matched, or nonmatched. During computer matching, potential duplicates were also identified.

In general, the matched addresses, possibly matched addresses, and nonmatched addresses including potential duplicates were sent to IHU Before Followup (BFU) clerical matching for matchers to confirm and resolve. BCUs with unresolved addresses were sent to IHUFU following IHU BFU clerical matching. Additionally, BCUs that fit certain scenarios skipped IHU BFU clerical matching and were sent directly to IHUFU. Example scenarios included:

- BCUs with no IL addresses and at least one census address.
- BCUs with no census addresses and at least one IL address.

In the IHUFU operation, addresses from either the IL or census that met predetermined criteria were followed up in the field to collect information needed for the IHU After Followup (AFU) clerical matching operation to determine unit status, match status, or both.

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<sup>1</sup> The preliminary census address list was constructed for the IHU Matching operation using the Enumeration Master Address File Extracts (MAFXs) and included information about census housing units and group quarters from each PES sample BCU and one ring of BCUs surrounding each sample BCU.



The criteria for IHUFU were:

- Census address not matched to an IL address in the same PES sample BCU.
- IL address not matched to a census address in the PES sample BCU or one ring of surrounding BCUs.
- IL and census addresses with a possible match status.
- IL address with unresolved unit status<sup>2</sup> regardless of match status.
- IL address with a duplicate regardless of match status.
- IL address matched or possibly matched to a census address in a surrounding BCU.
- Census address with a duplicate regardless of match status.
- IL address matched or possibly matched to a census group quarters.

The IHUFU workload was generated and sent to field daily. All follow-up paper forms and maps in a BCU were grouped into a single IHUFU packet. The IHUFU packets were printed and assembled at the National Processing Center (NPC) before being shipped to the regional census centers (RCCs) on a flow. The IHUFU listers and IHUFU Quality Control (QC) listers visited their assigned addresses, interviewed respondents, and recorded responses on the paper forms. After all the follow-up work in a BCU was completed, the IHUFU packet for that BCU was shipped back to NPC. The RCCs shipped the completed IHUFU packages back to NPC on a flow.

## **1.2 Initial Housing Unit Followup Field Collection Procedures**

As with all other 2020 PES follow-up operations, field staff used paper forms to collect the necessary information. The two types of field staff for IHUFU were listers and census field supervisors (CFSs). For IHUFU, all follow-up cases in a BCU were grouped into one IHUFU packet. The packet consisted of all follow-up case forms and all maps needed to complete the work in the BCU. There was one case form for each IHUFU case. An IHUFU case included an IL address with up to two duplicates, a census address with up to two duplicates, or a matched or possibly matched pair of IL and census addresses with up to two duplicates each. The questions included for each IHUFU case varied depending on the reason the address was sent to IHUFU.

For the nonmatched IL and census addresses, there was a separate follow-up form within the packet for each address. For possible matches and possible duplicates, there was one follow-up form for each group of linked addresses. The follow-up forms were customized for each individual situation. There were 32 different IHUFU case form types used. The IHUFU case form types will be discussed in detail in Section 5.1.

Efforts were made to collect the following information:

- BCU identification number (for an address that could be a match or duplicate in a surrounding BCU).

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<sup>2</sup> IL addresses with unresolved unit statuses included under construction, future construction, unfit for habitation, empty trailer pad, or other at the time of IL.

- Evidence to determine if there was a housing unit at the address on the date of the follow-up visit<sup>3</sup>. If the address in question was not a housing unit, a statement should be provided as to the reason for this determination.
- Whether or not two addresses (IL and census) identified as possible matches were the same unit (i.e., housing or group quarter).
- Whether or not two or more IL addresses identified as possible duplicates were the same unit.
- Whether or not two or more census addresses identified as possible duplicates were the same unit.
- IHUFU listers were also asked to identify any additional matches or duplicates observed in the field.

A QC check was performed on a random sample of each IHUFU lister's work in each BCU. The target QC sample size was 15 percent of IHUFU case forms. During the QC check, the QC lister independently verified the completeness and accuracy of a sample of the completed IHUFU case forms for the BCU. An IHUFU QC form was included in each IHUFU packet. This form listed a random sample of the IHUFU case form(s) to be checked during QC. The number of IHUFU QC case forms, as shown in Table 1: QC Check Sample for IHUFU, was determined based on the number of case forms in the BCU. See Roinestad (2020) for further details.

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<sup>3</sup> It was possible that some of the follow-up addresses were not housing units at the time of IL. In this situation, the IHUFU lister needed to determine if a housing unit actually existed at the address at the time of the IHUFU interview.

Table 1: QC Check Sample for IHUFU

Number of IHUFU Case Forms in BCU	Number of IHUFU Case Forms Selected for QC Check in BCU
1	1
2	2
3 – 4	3
5 – 7	4
8 – 10	5
11 – 17	6
18 – 29	7
30 – 61	8
62 – 259	9
260 – 419	20
420 – 599	21
600 – 879	33
880 – 999	34
1000 – 1344	47
1345 – 1489	61
1490 – 1774	62
1775 – 1848	76
1850 – 2199	77
>=2200	93

Source: U.S. Census Bureau, 2020 Census, Quality Assurance Plan for the 2020 Census Post-Enumeration Survey Initial Housing Unit Followup Operation and Final Housing Unit Followup Operation. See Roinestad (2020).

The QC lister also determined if any errors detected on the selected IHUFU case forms were critical. A BCU passed the QC check if the number of selected IHUFU case forms with one or more critical errors detected was less than or equal to the acceptance number designated for the size of the BCU (i.e., total number of selected IHUFU case forms). If a BCU failed the QC check, the QC lister dependently verified all the remaining IHUFU case forms in that BCU.

### 1.3 Operational Changes Resulting from COVID-19

#### IHUFU Workload Increase Because of COVID-19

In response to the COVID-19 pandemic, the IHU BFU clerical matching activities were scaled back and the start of the IHUFU operation was delayed by about three months. IHU computer matching was used to determine the majority of the addresses requiring follow-up. Puerto Rico BCUs were not worked in IHU BFU clerical matching, but instead went straight to IHUFU from IHU computer matching. These changes resulted in a higher IHUFU workload. The planned IHUFU production workload was 184,000 cases. The actual workload was 271,000 cases, an increase of 87,000 (47.3 percent) more cases than planned.

#### IHUFU Procedural Changes in Field Data Collection in Response to COVID-19

Procedural changes were implemented for IHUFU in response to COVID-19 that minimized contact at addresses. Because of COVID-19, IHUFU listers were allowed to complete the IHUFU forms by observation first before attempting to interview by telephone or by a personal visit. A

letter, along with a confidentiality notice, was mailed to an address that could not be confirmed by observation. The letter provided a phone number for the respondent to call the IHUFU lister to set up a telephone interview.

The following were examples of situations when a personal visit was required:

- Nonresponse: If after five days, the IHUFU case was not completed by observation or the respondent had not called to follow up after the letter was mailed, then a personal visit was required.
- Limited-access BCUs: There were certain BCUs (distance, military, tribal, gated community, etc.) where circumstances would make multiple in-person visits difficult. In these instances, conducting in-person interviews at the time of the initial visit was required.
- Group quarters: The IHUFU lister was required to conduct an interview either by personal visit or by telephone for a census address classified as group quarter but matched or possibly matched to an IL address.
- House number was not posted on the structure: If the house number was not visible, the IHUFU lister had to speak with a respondent in person.

## 1.4 Schedule

A subset of milestone activities for the IHUFU operation from the final baselined version of the 2020 Census Integrated Master Schedule appears below in Table 2. Milestone Activities for the IHUFU Operation The IHUFU soft launch was planned after a soft launch for the IL operation appeared to be beneficial. The IHUFU soft launch consisted of working at least one BCU in each RCC in advance of full production to confirm all systems were operational.

Table 2. Milestone Activities for the IHUFU Operation

Activity or Milestone Name	Planned Start	COVID-19 Replan Start	Actual Start	Planned Finish	COVID-19 Replan Finish	Actual Finish
IHUFU Lister Training	04/20/2020	07/13/2020	07/13/2020	05/06/2020	07/30/2020	07/30/2020
IHUFU Soft Launch	N/A	07/23/2020	07/23/2020	N/A	07/29/2020	07/30/2020
Conduct IHUFU Production	05/06/2020	07/30/2020	07/30/2020	06/12/2020	09/14/2020	09/25/2020
Conduct IHUFU QC Check	05/13/2020	08/06/2020	08/06/2020	06/19/2020	09/21/2020	09/25/2020

N/A stands for not applicable.

Source: U.S. Census Bureau, 2020 Census, Integrated Master Schedule and PES COVID-19 Planning.

## 2. Background

The 2020 PES was a complex survey conducted independently of the 2020 Census. For information on the entirety of the 2020 PES design, see Kennel (2022) and the U.S. Census Bureau (2020).

The 2020 PES included five field data collection operations and numerous sampling, matching, and estimation operations. These operations are covered in separate assessment reports. The five PES data collection operations were:

1. **PES IL Operation** – In the PES sample BCUs, the IL was conducted by personal visit using the Listing and Mapping Application (LiMA) on a laptop. Field staff, referred to as listers, listed all housing units and potential housing units in each PES sample BCU starting from a clean slate without previous housing unit information. Information about the number of housing units belonging to a particular structure was also collected.
2. **PES IHUFU Operation** (July 30 – September 25, 2020) – After the IL operation, the IHU Matching operation matched the results of the IL to the preliminary census address list. The addresses that needed additional information were sent to the IHUFU operation. IHUFU listers conducted a paper-based follow-up operation using a questionnaire with questions tailored to resolve any remaining issues between addresses from IL and the census address list, such as nonmatches or possible matches. This operation collected information needed to accurately determine the match status of housing units that had an unresolved match status. Possible duplicates and IL addresses where the listers indicated that the units had a status other than occupied or vacant at the time of listing were also contacted.
3. **PES Person Interview (PI) Operation** – Interviewers contacted selected housing units in the PES sample BCUs. They conducted interviews using an automated instrument, in person, or by telephone, to collect information on who lived there at the time of the PI interview, where else they usually lived or stayed, who lived there on Census Day (April 1, 2020), where else they could have been counted on Census Day, and whether anyone else lived at the address on Census Day who did not live there at the time of the PI interview.
4. **PES Person Followup (PFU) Operation** – The Person Matching operation followed the PI operation. The people that needed additional information were sent to PFU. PFU was conducted by personal visit using a paper questionnaire. PFU interviewers contacted people with unresolved residence status (to get more information about where the person was living) or unresolved enumeration status (to get more information about where the person should have been counted in the census), even when they may have been matched, to resolve any issues between the PES PI and the census in the PES

sample BCUs. People that were a possible match or possible duplicate were also contacted.

5. **PES Final Housing Unit Followup (FHUFU) Operation** – FHUFU was the last field operation for the PES. Information was collected to accurately determine the match status of housing units that had an unresolved match status during the Final Housing Unit Matching operation. The addresses from the final census address file (i.e., the Census Unedited File [CUF]) were matched against the IL address list. The CUF included additional addresses that were not on the preliminary census address list used in the earlier phases of the PES. There were also addresses that were on the preliminary census address list but not on the CUF. Interviewers conducted a paper-based follow-up operation using questionnaires tailored to resolve any remaining issues between addresses from IL and the CUF. The issues included nonmatches, possible matches, possible duplicates, surrounding BCU matches, and housing units listed during IL that matched to census group quarters.

Each field operation had its own QC component in which field staff conducted a quality check of a sample of production work. For more information on IHUFU QC, see Roinestad (2020). The QC operations typically began one week after the start of production and ended one week after the end of production.

## **2010 IHUFU Operation**

In the 2010 Census, the post-enumeration survey was known as the Census Coverage Measurement (CCM) survey. The operational design of the 2020 PES is similar to the 2010 CCM. The 2010 CCM IHUFU operation was conducted in the same manner as the 2020 IHUFU, with a few changes. The workload for the 2010 CCM IHUFU operation resulted from more clerical review in IHU BFU clerical matching and fewer cases directly from IHU computer matching. This clerical matching took all eligible results of IHU computer matching and had clerical matchers review and correct any errors or missed matches before sending to IHUFU.

The 2010 CCM IHUFU was estimated to cost \$20,688,471. The actual cost of the operation was under budget by 57.2 percent, costing \$8,861,614. For a full cost overview see Argarin et al. (2012).

The final 2010 CCM IHUFU workload was 177,630 addresses requiring follow-up for stateside and Puerto Rico. Of the addresses requiring follow-up, 86,260 (48.6 percent) were IL addresses, 78,448 (44.2 percent) were census addresses in the sample block clusters<sup>4</sup>, 252 (0.1 percent) were census group quarters in the sample block clusters, and 12,670 (7.1 percent) were census housing units in surrounding block clusters. For a full overview see Argarin et al. (2012).

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<sup>4</sup> Block clusters were sample geographical areas, selected for the 2010 CCM survey, containing one or more adjacent collection blocks. Their role was analogous to the role of BCUs in the 2020 PES.

## 2020 Research and Testing

The 2020 PES IHUFU operation was originally scheduled to be updated during the 2020 Research and Testing phase, but it was descope because of lack of funding. There was no testing of the IHUFU operation in the field before the soft launch on July 23, 2020.

## 3. Methodology

All 2020 Census operational assessments share a similar methodology. In general, they provide details about the implementation of individual operations and processes (including final volumes, rates, and costs) by presenting data from production systems, files, and activity reports, in addition to information collected from lessons learned and debriefings sessions. These important measures are key ingredients to defining successful completion of the 2020 Census operations and processes. Typical categories of success measures are as follows:

- **Process Measures** that indicate how well the process works, typically including measures related to completion dates, rates, and productivity rates.
- **Cost Measures** that drive the cost of the operation and comparisons of actual costs to planned budgets. Costs can include workload as well as different types of resource costs.
- **Quality Measures** of operational results, typically including things such as rework rates, error rates, and coverage rates.

In addition to planning and managing the implementation of its operation, each Integrated Project Team (IPT) had the responsibility of determining the assessment questions for its operation. In consultation with the Decennial Research Objectives and Methods (DROM) Working Group, each IPT developed assessment questions tailored to the uniqueness of its operation that would yield the most useful information to those planning similar operations in the future. Assessment questions provide the framework for the Results Section appearing in each operational assessment report.

The sections that follow present the assessment questions for this operation and describe the sources of information used to answer them. Please note that the numbers appearing in this operational assessment report have been subjected to the U.S. Census Bureau's approved disclosure avoidance techniques including noise injection and rounding.

### 3.1 Assessment Questions

The following research questions will be answered to summarize and assess the IHUFU operation.

1. Workloads and workflow results
  - a. How many BCUs and addresses were sent to IHUFU?

- b. What types of case forms were sent to IHUFU?
  - c. What were the results of IHUFU QC?
- 2. Schedule, hiring, and cost results
  - a. How did actual start and completion dates compare to planned start and completion dates?
  - b. How did actual hiring and training numbers compare to planned?
  - c. Were the field operations over or under budget?
- 3. Lessons learned
  - a. What would the PES IPT change about the implementation of the 2020 PES IHUFU operation?
  - b. What major challenges does the PES IPT foresee affecting the implementation of the IHUFU operation in the future?

### **3.2 Data Sources and Calculations: Production Systems/Reports**

Daily form files and BCU control files output by Clerical Match and Map Update (CMMU) during the IHU BFU clerical matching activities were delivered to the Decennial Statistical Studies Division (DSSD) servers where they were used to answer the workloads and workflow results research questions.

### **3.3 Lessons Learned and Debriefing Sessions**

The 2020 IHUFU debriefing questionnaire survey was taken on the Learning Monitoring System by the IHUFU listers and CFSs for IHUFU production and IHUFU QC. This survey was taken at the end of the IHUFU operation from August 29, 2020, to September 30, 2020. The questions in the survey consisted of multiple choice and write-in answers.

In addition to the lister and CFS debriefings, there was a debriefing of the RCC management. This debriefing was held on October 5, 2020, and October 6, 2020, through teleconference. Each RCC had a spokesperson. The debriefing responses include each RCC's written submission and what was discussed during the teleconference.

The PES Field Operations IPT was given an opportunity to provide lessons learned through an online survey through SharePoint.

## **4. Limitations**

The information provided by the Unified Tracking System (UTS) for the questions about the fieldwork hours and fieldwork costs was not broken down to the level of detail outlined in the study plan. The data for the budgeted and actual housing units worked and the budgeted and actual total cost was not available for lister and CFS positions at the BCU level. Therefore, portions of question 2b and 2c were not able to be assessed and were not included in the results.



## 5. Results

### 5.1 Workloads and Workflow Results

#### a) How many BCUs and addresses were sent to IHUFU?

The workload for IHUFU was determined from the IHU computer matching and IHU BFU clerical matching.

Table 3 shows the number of BCUs sent to IHUFU by RCC. Out of 8,500 BCUs included in the IHU Matching operation, including computer and clerical matching, 7,400 (87.1 percent) of BCUs required follow-up and were sent to IHUFU. Stateside BCUs accounted for 7,100 of the 7,400 total BCUs sent to IHUFU (86.6 percent). The Dallas RCC had the largest quantity of BCUs requiring follow-up while the New York RCC had the smallest quantity stateside. Of the 300 Puerto Rico PES sample BCUs, 300 (100.0 percent) required follow-up. A higher percentage of Puerto Rico BCUs went to IHUFU because Puerto Rico BCUs were not worked in IHU BFU clerical matching.

Table 3: BCUs Sent to IHUFU by RCC: Unweighted

RCCs	BCUs				Total PES Sample BCUs	Percent of Total PES Sample BCUs
	Requiring Follow-up		Not Requiring Follow-up			
	Count	Row Percent	Count	Row Percent		
Stateside Total	7,100	86.6	1,100	13.4	8,200	96.5
New York (Excluding Puerto Rico)	900	90.0	90	9.0	1,000	11.8
Philadelphia	1,000	83.3	200	16.7	1,200	14.1
Chicago	1,100	84.6	200	15.4	1,300	15.3
Atlanta	1,200	85.7	150	10.7	1,400	16.5
Dallas	1,700	89.5	250	13.2	1,900	22.4
Los Angeles	1,200	85.7	150	10.7	1,400	16.5
Puerto Rico Total	300	100.0	N<15	0.0	300	3.5
Total (Stateside and Puerto Rico)	7,400	87.1	1,100	12.9	8,500	100.0

Note: Numbers may not sum to totals because of rounding.

Source: U.S. Census Bureau, 2020 PES Initial Housing Unit Followup Operation Results.

Table 4 displays the range of IHUFU case forms in each BCU sent to IHUFU for stateside and Puerto Rico separately. Recall that each IHUFU case form could contain one or more addresses to be followed up. An IHUFU case form could include an IL address, a census address, or a matched or possibly matched pair of IL and census addresses. Overall, more than half, specifically 4,700 BCUs (63.5 percent), had one to 19 IHUFU case forms. The highest percentage of stateside IHUFU BCUs (18.3 percent) was in the 10 to 19 case forms range. In Puerto Rico, however, the largest percentage of the BCUs (33.3 percent) requiring follow-up contained 100 or more case forms.

Additionally, the largest IHUFU packet (i.e., all follow-up work in a BCU) for stateside contained 1,206 IHUFU case forms. The largest IHUFU packet for Puerto Rico contained 865 IHUFU case forms.

Table 4. Range of IHUFU Case Forms in Each IHUFU BCU: Unweighted

Range of IHUFU Case Forms	Stateside BCUs		Puerto Rico BCUs		Total BCUs	
	Count	Percent of Total	Count	Percent of Total	Count	Percent of Total
1 – 2	1,200	16.9	N<15	0.0	1,200	16.2
3 – 5	1,200	16.9	N<15	0.0	1,200	16.2
6 – 9	1,000	14.1	N<15	0.0	1,000	13.5
10 – 19	1,300	18.3	30	10.0	1,300	17.6
20 – 49	1,200	16.9	70	23.3	1,300	17.6
50 – 99	600	8.5	60	20.0	700	9.5
100+	550	7.7	100	33.3	700	9.5
<b>Total</b>	<b>7,100</b>	<b>100.0</b>	<b>300</b>	<b>100.0</b>	<b>7,400</b>	<b>100.0</b>

Note: Numbers may not sum to totals because of rounding.

Source: U.S. Census Bureau, 2020 PES Initial Housing Unit Followup Operation Results.

Table 5 shows the number of addresses sent to IHUFU by RCC. Of the 345,000 addresses requiring follow-up, 133,000 were IL addresses and 212,000 were census addresses. The Los Angeles RCC had the highest percentage of addresses (18.3 percent) requiring follow-up, followed by the Atlanta RCC with 17.5 percent of the total. The Chicago RCC had the smallest percentage of addresses requiring follow-up at 9.7 percent. In Puerto Rico, 10.7 percent of all addresses (37,000 addresses) required follow-up.

Table 5: Addresses Sent to IHUFU by RCCs: Unweighted

RCCs	IL		Census		Total	
	Count	Percent of Total	Count	Percent of Total	Count	Percent of Total
<b>Stateside Total</b>	<b>116,000</b>	<b>87.2</b>	<b>192,000</b>	<b>90.6</b>	<b>308,000</b>	<b>89.3</b>
New York (Excluding Puerto Rico)	21,000	15.8	30,000	14.2	51,500	14.9
Philadelphia	16,500	12.4	25,000	11.8	41,500	12.0
Chicago	13,000	9.8	20,500	9.7	33,500	9.7
Atlanta	22,000	16.5	39,000	18.4	60,500	17.5
Dallas	20,500	15.4	37,500	17.7	58,000	16.8
Los Angeles	23,000	17.3	39,500	18.6	63,000	18.3
<b>Puerto Rico Total</b>	<b>17,000</b>	<b>12.8</b>	<b>20,000</b>	<b>9.4</b>	<b>37,000</b>	<b>10.7</b>
<b>Total (Stateside and Puerto Rico)</b>	<b>133,000</b>	<b>100.0</b>	<b>212,000</b>	<b>100.0</b>	<b>345,000</b>	<b>100.0</b>

Note: Numbers may not sum to totals because of rounding.

Source: U.S. Census Bureau, 2020 PES Initial Housing Unit Followup Operation Results.

Table 6 shows the number of addresses in IHUFU by address type record. Addresses identified for follow-up could come from either the IL address list or the preliminary census address list.

Table 6 identifies the number of addresses sourced from the IL address list and categorizes the number of census addresses as housing units in the PES sample BCU, group quarters in the PES sample BCU, or housing units in a surrounding BCU. Note that a census address in a surrounding BCU referred to a census address that was matched or possibly matched to an IL address in a PES sample BCU. A census address in a surrounding BCU could also be a duplicate of a census address in a sample BCU. The IHUFU lister had to determine the correct BCU.

Table 6 shows that there were 345,000 addresses requiring follow-up in stateside and Puerto Rico. Of the addresses requiring follow-up, 181,000 (52.5 percent) were census addresses in the PES sample BCUs, 133,000 (38.6 percent) were IL addresses, 30,500 (8.8 percent) were census addresses in a surrounding BCU, and 200 (0.1 percent) were census group quarters in the PES sample BCUs. As separate entities, stateside and Puerto Rico both reported the majority of IHUFU addresses as census addresses in PES sample BCUs at 52.6 percent and 50.0 percent, respectively.

To give context to the IHUFU workload in terms of addresses, 133,000 IL addresses required follow-up out of 531,000 IL addresses included in IHU matching (25.0 percent), see McGinnis et al. (Forthcoming). There were 181,000 census addresses out of 579,000 census housing units and group quarter addresses in PES sample BCUs (31.3 percent) that required follow-up, see McGinnis et al. (Forthcoming).

Table 6: Addresses in IHUFU by Address Type Record: Unweighted

Address Type Record	Stateside		Puerto Rico		Total	
	Count	Percent	Count	Percent	Count	Percent
IL Addresses	116,000	37.7	17,000	45.9	133,000	38.6
Census Addresses in PES Sample BCUs	162,000	52.6	18,500	50.0	181,000	52.5
Census Group Quarters in PES Sample BCUs	200	0.1	N<15	0.0	200	0.1
Census Addresses in Surrounding BCUs	29,500	9.6	1,400	3.8	30,500	8.8
<b>Total Addresses Requiring Follow-up (Stateside and Puerto Rico)</b>	<b>308,000</b>	<b>100.0</b>	<b>37,000</b>	<b>100.0</b>	<b>345,000</b>	<b>100.0</b>

Note: Numbers may not sum to totals because of rounding.

Source: U.S. Census Bureau, 2020 PES Initial Housing Unit Followup Operation Results.

b) What types of case forms were sent to IHUFU?

Table 7 shows that five case form types accounted for 95.5 percent of all forms generated for IHUFU. There were 32 IHUFU case form types used. Each form type had questions tailored to the IHUFU case needing follow-up. For example, a census address without a link to an IL address was sent to follow-up using a Census Nonmatched Address (NE) form. Additional form types were available but not listed in Table 7: Distribution of IHUFU Case Forms: Unweighted because they were not used for the 2020 PES. For additional information on all IHUFU case form types, refer to Appendix B. 138,000 IHUFU cases (50.9 percent) used the Census Nonmatched Address (NE) form; 65,500 IHUFU cases (24.2 percent) used the PES Nonmatched Address (NI) form; 27,000 IHUFU cases (10.0 percent) used the Possible PES-Census Match (P) form; 24,500 IHUFU cases (9.0 percent) used the Surrounding BCU Match (M\*SB) form; and

3,900 IHUFU cases (1.4 percent) used the PES-Census Match/Duplicate Census Address (M/DE) form. All the other form types ranged from a quantity of N<15 to 3,800.

Note that in this research question, the IL address is called PES address. Also, the term “PES listed” in Appendix B is used to mean that the address was listed during the IL operation.

Table 7: Distribution of IHUFU Case Forms: Unweighted

IHUFU Case Form Type	Stateside		Puerto Rico		Total	
	Count	Column Percent	Count	Column Percent	Count	Percent of Total
Census Nonmatched Address (NE)	124,000	51.7	14,500	46.0	138,000	50.9
PES Nonmatched Address (NI)	54,000	22.5	11,500	36.5	65,500	24.2
Possible PES-Census Match (P)	23,500	9.8	3,700	11.7	27,000	10.0
Surrounding BCU Match (M*SB)	24,000	10.0	350	1.1	24,500	9.0
PES-Census Match/Duplicate Census Address (M/DE)	3,800	1.6	150	0.5	3,900	1.4
Unit Status Update (M*)	3,800	1.6	20	0.1	3,800	1.4
Surrounding BCU Match/Possible PES-Census Match (P*SB)	2,400	1.0	950	3.0	3,300	1.2
Unit Status Update/Possible PES-Census Match (P*)	1,100	0.5	60	0.2	1,200	0.4
Census Nonmatched and Duplicate Addresses (NE/DE)	1,100	0.5	0	0.0	1,100	0.4
PES-Census Match/Duplicate PES Address (M/DI)	550	0.2	N<15	0.0	600	0.2
Possible PES-Census Match/Duplicate Census Address (P/DE)	450	0.2	0	0.0	450	0.2
Unit Status Update and Surrounding BCU Match (M*USSB)	300	0.1	0	0.0	300	0.1
Surrounding BCU Match/Duplicate Census Address (M*SB/DE)^	300	0.1	N<15	0.0	300	0.1
Surrounding BCU Match/Duplicate PES Address (M*SB/DI)	200	0.1	N<15	0.0	200	0.1
Unit Status Update and Surrounding BCU Match / Possible PES-Census Match (P*USSB)	150	0.1	20	0.1	150	0.1
Group Quarters (GQ)	150	0.1	0	0.0	150	0.1
Unit Status Update/Duplicate Census Address (M*/DE)	80	0.0	N<15	0.0	80	0.0
PES-Census Match/Two Duplicate Census Addresses (M/DE/DE)	60	0.0	N<15	0.0	70	0.0
Group Quarters with Census Address Possible Match (GQ*)	60	0.0	N<15	0.0	60	0.0
Possible PES-Census Match/Duplicate PES Address (P/DI)	30	0.0	0	0.0	30	0.0
PES-Census Match/Two Duplicate PES Addresses (M/DI/DI)	30	0.0	N<15	0.0	30	0.0

IHUFU Case Form Type	Stateside		Puerto Rico		Total	
	Count	Column Percent	Count	Column Percent	Count	Percent of Total
All Other Case Form Types	60	0.0	N<15	0.0	60	0.0
<b>Total IHUFU Case Forms</b>	<b>240,000</b>	<b>100.0</b>	<b>31,500</b>	<b>100.0</b>	<b>271,000</b>	<b>100.0</b>

^Form type Surrounding BCU Match/Duplicate Census Address (M\*SB/DE) and Surrounding BCU Match/Two Duplicate Census Addresses (M\*SB/DE/DE) were used in IHUFU; however, should have only been available in FHUFU.

Note: Numbers may not sum to totals because of rounding.

Source: U.S. Census Bureau, 2020 PES Initial Housing Unit Followup Operation Results.

### c) What were the results of IHUFU QC?

The total IHUFU case forms selected for QC was 42,000 (15.5 percent). Table 8 shows the range of IHUFU QC case forms in each BCU. Almost half of the total BCUs, 3,600 BCUs (48.6 percent) had 6 to 19 IHUFU QC case forms. The largest number of IHUFU QC case forms in a BCU was in the 20-47 range. For stateside and Puerto Rico individually, 2.1 percent and 6.7 percent of BCUs, respectively, had 20 to 47 IHUFU QC case forms.

Table 8: Range of IHUFU QC Case Forms in Each BCU: Unweighted

Range of IHUFU QC Case Forms	Stateside BCUs		Puerto Rico BCUs		Total BCUs	
	Count	Percent of Total	Count	Percent of Total	Count	Percent of Total
1 – 2	1,200	16.9	N<15	0.0	1,200	16.2
3 – 5	2,400	33.8	20	6.7	2,400	32.4
6 – 19	3,300	46.5	250	83.3	3,600	48.6
20 – 47	150	2.1	20	6.7	200	2.7
<b>Total</b>	<b>7,100</b>	<b>100.0</b>	<b>300</b>	<b>100.0</b>	<b>7,400</b>	<b>100.0</b>

Note: Numbers may not sum to totals because of rounding.

Source: U.S. Census Bureau, 2020 PES Initial Housing Unit Followup Operation Results.

Table 9 shows the number of BCUs that failed or passed the QC check by RCC. Overall, 5,900 BCUs (79.7 percent) passed the QC check. The Dallas RCC had the highest pass rate at 88.2 percent (1,500 out of 1,700 BCUs passing the QC check). The Chicago RCC had the lowest pass rate at 68.2 percent (750 out of 1,100 BCUs). If a BCU failed the QC check, the QC lister independently verified and corrected all the remaining IHUFU case forms in that BCU.

Table 9: IHUFU QC BCUs Complete for IHUFU: Unweighted

RCC	BCUs Failed QC		BCUs Passed QC		Total BCUs
	Count	Failed Percent	Count	Passed Percent	
New York (Including Puerto Rico)	350	29.2	850	70.8	1,200
Philadelphia	250	25.0	800	80.0	1,000
Chicago	300	27.3	750	68.2	1,100
Atlanta	200	16.7	1,000	83.3	1,200
Dallas	100	5.9	1,500	88.2	1,700
Los Angeles	300	25.0	900	75.0	1,200
<b>Total (Stateside and Puerto Rico)</b>	<b>1,500</b>	<b>20.3</b>	<b>5,900</b>	<b>79.7</b>	<b>7,400</b>

Note: Numbers may not sum to totals because of rounding.

Source: U.S. Census Bureau, 2020 PES Initial Housing Unit Followup Operation Results.

## 5.2 Schedule, Hiring, and Cost Results

- a) How did actual start and completion dates compare with planned start and completion dates?

The IHUFU operation milestone dates were provided by the 2020 PES Integrated Master Schedule maintained by the Decennial Census Management Division (DCMD) and the PES COVID-19 Planning document created by the IPT. The IHUFU operation was conducted from July 30, 2020, to September 25, 2020, a delay of about three months because of the COVID-19 pandemic. The duration of the IHUFU operation lasted 41 days versus the 27 days originally planned. The IHUFU QC work was also delayed by about three months. IHUFU QC started on August 6, 2020, and ended on September 25, 2020. Table 2. Milestone Activities for the IHUFU Operation listed the milestone activities for the 2020 IHUFU operations.

- b) How did actual hiring and training numbers compare to planned?

The Field Division planned for an upper limit for hiring in each RCC. Each RCC was able to hire for each position at their discretion based on their regional implementation plans for IHUFU production and IHUFU QC. Staff were hired and trained before the start of the IHUFU operation based on where people were needed geographically. Table 10 shows the planned and the actual staff hired and trained for IHUFU production and IHUFU QC. IHUFU production and IHUFU QC both hired and trained more CFSs than planned at 300.0 percent and 125.0 percent, respectively. There were 2,300 IHUFU production and IHUFU QC staff planned for the IHUFU operation, but 4,100 were hired and trained (i.e., 178.3 percent of the planned were hired and trained).

Table 10: Field Staffing Level: Planned and Actual (Including Stateside and Puerto Rico)

Staffing	IHUFU Production			IHUFU QC			Total IHUFU Production and IHUFU QC
	Lister	CFS	Total	Lister	CFS	Total	
Planned	1,700	150	1,800	400	40	450	2,300
Actual Hired and Trained	3,300	450	3,700	400	50	450	4,100
Percentage of Planned Staff Hired and Trained	194.1	300.0	205.6	100.0	125.0	100.0	178.3

Note: Numbers may not sum to totals because of rounding.

Source: U.S. Census Bureau, 2020 PES Initial Housing Unit Followup Operation Results.

c) Were the field operations over or under budget?

IHUFU listers and CFSs were the two types of staff working in the field. IHUFU listers were responsible for using follow-up paper forms to collect the necessary information to resolve remaining discrepancies between IL addresses and the preliminary census address list. Each CFS supervised a team of IHUFU listers.

Table 11 shows the budgeted and actual cost (excluding training) by position for both IHUFU production and IHUFU QC. The IHUFU production total actual cost was about \$4,520,887. IHUFU production actual total CFSs cost \$1,299,928 more than budgeted while the listers, however, cost \$3,275,166 less than budgeted. Ultimately, the IHUFU production cost was 30.4 percent under the budgeted cost. The changes in field procedures for IHUFU production because of COVID-19 such as allowing addresses to be completed by observation first, likely led to shorter interviews and less visits allowing IHUFU to remain under budget. The IHUFU QC total cost was \$2,360,786 (35.0 percent) over the budgeted cost. The IHUFU QC operation overspent in the lister position by \$4,101 and overspent in the CFS position by \$607,473. IHUFU QC field procedures were not affected by COVID-19, so the higher-than-expected IHUFU QC workload caused IHUFU QC to be over budget.

Table 11: Total Budgeted and Actual Cost Excluding Training by IHUFU Production, IHUFU QC, and Position (Including Stateside and Puerto Rico)

Position	Budgeted Total Cost	Actual Total Cost	Difference of Budgeted to Actual Cost	Percent Difference of Budgeted to Actual Cost
<b>IHUFU Production</b>				
<b>Total IHUFU Production</b>	<b>\$6,496,126</b>	<b>\$4,520,887</b>	<b>\$1,975,239</b>	<b>30.4</b>
Lister	\$5,774,321	\$2,499,155	\$3,275,166	56.7
CFS	\$721,805	\$2,021,732	(\$1,299,928)	(180.1)
<b>IHUFU QC</b>				
<b>Total IHUFU QC</b>	<b>\$1,749,212</b>	<b>\$2,360,786</b>	<b>(\$611,574)</b>	<b>(35.0)</b>
Lister	\$1,556,073	\$1,560,174	(\$4,101)	(0.3)
CFS	\$193,139	\$800,612	(\$607,473)	(314.5)

Note: Results rounded to the nearest dollar.

Note: Values in parentheses denote values over budget.

Source: U.S. Census Bureau, 2020 PES Initial Housing Unit Followup Operation Results.

Table 12: Total Budgeted and Actual Fieldwork Hours by IHUFU Production, IHUFU QC, and Position (Including Stateside and Puerto Rico) shows the budgeted fieldwork hours compared to the actual fieldwork hours. There were 213,048 budgeted hours and 137,746 actual hours worked in IHUFU production. In IHUFU QC, the actual fieldwork hours were higher than the 51,331 budgeted hours resulting in a total of 60,178 actual hours. For the CFS position, IHUFU production and IHUFU QC were over the budgeted hours by 40,650 and 17,518 hours, respectively. The changes in field procedures for IHUFU production because of COVID-19 such as allowing addresses to be completed by observation first, likely led to shorter interviews and less visits so fewer fieldwork hours were required. IHUFU QC field procedures prior to COVID-19 already encouraged observation and short interviews, so the higher-than-expected IHUFU QC workload resulted in IHUFU QC using more fieldwork hours than budgeted.

Table 12: Total Budgeted and Actual Fieldwork Hours by IHUFU Production, IHUFU QC, and Position (Including Stateside and Puerto Rico)

Position	Budgeted Fieldwork Hours	Actual Fieldwork Hours	Difference of Budgeted to Actual Fieldwork Hours	Percent Difference of Budgeted to Actual Fieldwork Hours
<b>IHUFU Production</b>				
<b>Total IHUFU Production</b>	<b>213,048</b>	<b>137,746</b>	<b>75,302</b>	<b>35.3</b>
Lister	190,789	74,838	115,952	60.8
CFS	22,259	62,909	(40,650)	(182.6)
<b>IHUFU QC</b>				
<b>Total IHUFU QC</b>	<b>51,331</b>	<b>60,178</b>	<b>(8,847)</b>	<b>(17.2)</b>
Lister	45,968	37,297	8,670	18.9
CFS	5,363	22,881	(17,518)	(326.6)

Note: Results rounded to the nearest hour.

Note: Values in parentheses denote values over budget.

Source: U.S. Census Bureau, 2020 PES Initial Housing Unit Followup Operation Results.



The production rate was defined as the effort required to complete a single case form in terms of fieldwork hours. Table 13 includes the production rates for the IHUFU production and IHUFU QC. The actual production rate for IHUFU production was 2.0 cases per hour, which was more than twice the budgeted production rate of 0.9 cases per hour. The actual production rate of IHUFU QC was 0.7 cases per hour compared to the budgeted 0.5 cases per hour.

Table 13: Total Production Rate by IHUFU Production and IHUFU QC (Including Stateside and Puerto Rico)

IHUFU Operation Component	Number of Cases Worked		Fieldwork Hours		Production Rate (Cases/Hours)	
	Budgeted	Actual	Budgeted	Actual	Budgeted	Actual
IHUFU Production	184,000	271,000	213,048	137,746	0.9	2.0
IHUFU QC	27,500	42,000	51,331	60,178	0.5	0.7

Note: Results rounded to the nearest hour.

Source: U.S. Census Bureau, 2020 PES Initial Housing Unit Followup Operation Results.

The higher-than-expected IHUFU workload did not result in higher actual fieldwork hours than the hours budgeted for the IHUFU production. Also, the actual production rates for the IHUFU production and IHUFU QC were higher than budgeted. The changes in field procedures for IHUFU production because of COVID-19 such as allowing addresses to be completed by observation first, likely led to shorter interviews and less visits. Even with the larger workload, the shorter interviews allowed IHUFU to remain under budget. IHUFU QC field procedures prior to COVID-19 already encouraged observation, so the higher-than-expected IHUFU QC workload caused IHUFU QC to use more fieldwork hours than budgeted.

### 5.3 Lessons Learned

- a) What would the PES IPT change about the implementation of the 2020 PES IHUFU operation?

There were several lessons learned during 2020 PES IHUFU operation, which led to suggestions for changes to the 2030 IHUFU operation. The following list of lessons learned was derived from the IPT and from field's debriefing reports:

- Online training alone was not effective enough in preparing staff for fieldwork. Training should be updated with more interactive elements including role play exercises and practice cases with various field scenarios (such as how to work multiunits or unlocatable units, or how to use maps), alongside videos of cases being worked.
- Training should increase focus on actual daily duties of field staff (CFSs, production listers, QC listers), not just the overall operation. Additional training on maps and map spotting as well as QC training on pass, fails, and critical errors would be beneficial.
- Incorporate IHUFU forms and packet completion activities into training, specifically, instructor-led lessons filling out forms (coversheet to last page).

- CFSs requested more training on the management applications (Mobile Case Management, Regional Office Sample Control System, Field Operational Control System) so they can better assist their staff.
  - IHUFU as a paper operation caused multiple issues with the size of the IHUFU packets, the difficulty to track packets and progress, and shipping delays. IHUFU packet size was difficult to handle, especially when they included hundreds of pages. The use of paper made it difficult to track missing maps and duplicate maps and track staff progress. There were also delays with the courier service (FedEx) used to ship packages.
  - Field staff had general trouble with maps including usage, map spotting, and understanding (may have stemmed from listing errors in the IL operation).
- b) What major challenges does the PES IPT foresee affecting the implementation of the IHUFU operation in the future?

An automated IHUFU instrument that includes automated mapping is something the Census Bureau has never done before for a post-enumeration survey. Combining automated listing and mapping instruments could be challenging. PES may be able to leverage systems that will be developed for decennial census operations for the 2030 IHUFU operation. On the other hand, continuing to use paper forms to collect data would require space and logistics that are no longer commonly used in a digital world. If we continue to use paper, the data collection will be inefficient and potentially inaccurate. To continue with the new developments of the future, the PES will need sufficient funding. Without proper funding, the 2030 IHUFU operation would suffer.

## **6. Conclusions and Recommendations**

In this section, we summarize the results of the IHUFU operation. These results are from an operational standpoint and are not the final PES estimates of coverage.

### **6.1 Conclusions**

The 2020 PES IHUFU operation was managed from the six RCCs. IHUFU production was conducted from July 30, 2020, to September 25, 2020, and IHUFU QC was conducted from August 6, 2020, to September 25, 2020. The start of both the IHUFU production and QC was delayed about three months because of the COVID-19 pandemic.

The IHUFU workload consisted of 7,400 BCUs in total, with the stateside workload of 7,100 BCUs and the Puerto Rico workload of 300 BCUs.

The number of IHUFU case forms varied in each BCU. Of the 7,400 BCUs, 1,300 (17.6 percent) had 10 to 19 IHUFU case forms. Stateside, the largest percentage of BCUs, specifically, 1,300 BCUs (18.3 percent), also had 10 to 19 IHUFU case forms. In Puerto Rico, however, most of the BCUs requiring follow-up, 33.3 percent, had 100 or more IHUFU case forms.

Each IHUFU case form could contain one or more addresses to be followed up that were either IL addresses, census addresses, or both. There were 345,000 addresses requiring follow-up, with 308,000 of the addresses (89.3 percent) located stateside and 37,000 of the addresses (10.7 percent) located in Puerto Rico. Of the 345,000 addresses requiring follow-up, 133,000 were IL addresses and 212,000 were census addresses. Of the 345,000 addresses requiring follow-up, 181,000 (52.5 percent) were census addresses in the sample BCUs, 133,000 (38.6 percent) were IL addresses, 30,500 (8.8 percent) were census addresses in a surrounding BCUs, and 200 (0.1 percent) were census group quarters in the sample BCUs.

Five IHUFU case form types accounted for 95.5 percent of all forms generated for IHUFU. There were over 30 IHUFU case form types used.

Of the 7,400 BCUs checked during IHUFU QC, 3,600 BCUs (48.7 percent) had six to 19 IHUFU case forms. Overall, 5,900 BCUs (79.7 percent) passed the QC check.

There were 2,300 total field staff planned for the IHUFU operation (production and QC), but 4,100 were hired and trained (i.e., 178.3 percent of the planned total).

The IHUFU operation was estimated to cost \$6,496,126 for IHUFU production and \$1,749,212 for IHUFU QC (excluding training). IHUFU production was under budget by \$1,975,239 while IHUFU QC was over budget by \$611,574.

Of the 213,048 budgeted fieldwork hours, only 137,746 hours were needed to complete the IHUFU production. IHUFU QC worked 8,847 more fieldwork hours than the budgeted amount of 51,331 hours.

The production rate was defined as the effort required to complete a single case form in terms of fieldwork hours. The actual production rate for IHUFU production was 2.0 cases per hour, which was more than twice the budgeted production rate of 0.9 cases per hour. The actual production rate of IHUFU QC was 0.7 cases per hour compared to the budgeted 0.5 cases per hour.

## **6.2 Recommendations**

Based on the goals and scope of the PES IHUFU operation, high-level recommendations for the 2030 PES and beyond are given below.

1. IHUFU should use an automated instrument for data collection. Listers felt the amount of paper materials needed during the operation was too cumbersome. The logistics needed to move the paper forms around in the field and at the National Processing Center (NPC) were complicated and time consuming.

2. Electronic maps should be used for IHUFU instead of paper maps. Paper maps proved difficult to use. The similar appearance of the various types of maps caused confusion and improper usage among the listers. Electronic maps would be more manageable in the field.
3. Training should be updated with more interactive elements and focus on actual daily duties of field staff. This includes role play exercises and practice cases with various field scenarios (such as how to work multiunits or unlocatable units, or how to use maps), alongside videos of cases being worked. Additional training on maps and map spotting as well as QC training on pass, fails, and critical errors would be beneficial. Field staff expressed that online training alone was not effective enough in preparing them for fieldwork.
4. RCCs requested that for future operations, the IHUFU production and QC be considered as separate operations in the operations control system used in the field, as tracking BCUs' status between IHUFU production and QC was difficult when these were considered as one operation.

## 7. Review / Approval Table

The individuals or groups that appear in the table below have reviewed and approved this operational assessment report.

Role	Approval Date
DCMD Assistant Division Chief for PES	12/14/2022
DROM Working Group	11/29/2022
Decennial Communications Coordination Office	10/03/2023

## 8. Document Revision and Version Control History

The table below includes entries for each major version of this operational assessment report along with a brief description of the version and any changes made to the preceding version.

Version/Editor	Date	Version Description/Revisions
1.0/Bernstein	10/03/2023	Final Version Approved for Public.

## 9. References

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Kennel, Timothy (2022), “The Design of the Post-Enumeration Survey for the 2020 Census,” DSSD 2020 Census Post-Enumeration Survey Memorandum Series #2020-B-01.

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Roinestad, Kristine (2020), “Quality Assurance Plan for the 2020 Census Post-Enumeration Survey Initial Housing Unit Followup Operation and Final Housing Unit Followup Operation,” DSSD 2020 Census Post-Enumeration Survey Memorandum Series #2020-D-07 or DSSD 2020 Decennial Census Memorandum Series #Q-12.

U.S. Census Bureau (2020), “2020 Census Detailed Operational Plan for: Post-Enumeration Survey (PES) Operations—Including: 27. CMDE, 28. CMM, and 29. CMFO,” Version 1.0, April 16, 2020.

## Appendix A: Glossary of Acronyms

Acronym	Definition
AFU	After Followup
BCU	Basic Collection Unit
BFU	Before Followup
CCM	Census Coverage Measurement
CFS	Census Field Supervisors
CMMU	Clerical Match and Map Update
CUF	Census Unedited File
DCMD	Decennial Census Management Division
DROM	Decennial Research Objectives and Methods Working Group
DSSD	Decennial Statistical Studies Division
FHUFU	Final Housing Unit Followup
IHU	Initial Housing Unit
IHUFU	Initial Housing Unit Followup
IL	Independent Listing
IPT	Integrated Project Team
LiMA	Listing and Mapping Application
MAFx	Master Address File Extracts
NPC	National Processing Center
PES	Post-Enumeration Survey
PFU	Person Followup
PI	Person Interview
QC	Quality Control
RCC	Regional Census Center
UTS	Unified Tracking System

## Appendix B: Type, Title, Definition, Availability, and Usage of IHUFU Case Form Types for the 2020 PES

Type	Title	Definition	Available in IHUFU	Used in IHUFU
<b>M/DE</b>	PES-Census Match/Duplicate Census Address	The PES and census address match. The census address is a possible duplicate with another census address. Determine if the addresses on the census list are the same.	Yes	Yes
<b>M/DE/DE</b>	PES-Census Match/Two Duplicate Census Addresses	The PES and census address match. The census addresses are possible duplicates with other census addresses. Determine if the addresses on the census list are the same.	Yes	Yes
<b>M/DI</b>	PES-Census Match/Duplicate PES Address	The PES and census address match. The PES address is a possible duplicate with another PES address. Determine if the addresses on the PES list are the same.	Yes	Yes
<b>M/DI/DI</b>	PES-Census Match/Two Duplicate PES Addresses	The PES and census address match. The PES addresses are possible duplicates with other PES addresses. Determine if the addresses on the PES list are the same.	Yes	Yes
<b>NE</b>	Census Nonmatched Address	The census listed an address that PES did not. Determine if the census address is a housing unit.	Yes	Yes
<b>NE/DE</b>	Census Nonmatched and Duplicate Addresses	The census listed an address that PES did not. The census address is a possible duplicate with another census address. Determine if the census address is a housing unit and if the addresses on the census list are the same.	Yes	Yes

Type	Title	Definition	Available in IHUFU	Used in IHUFU
<b>NE/DE/DE</b>	Census Nonmatched/Two Duplicate Census Addresses	The census listed an address that PES did not. The census addresses are possible duplicates with other census addresses. Determine if the census address is a housing unit and if the addresses on the census list are the same.	Yes	Yes
<b>NI</b>	PES Nonmatched Address	The PES listed an address that the census did not. Determine if the PES address is a housing unit.	Yes	Yes
<b>NI/DI</b>	PES Nonmatched and Duplicate Addresses	The PES listed an address that the census did not. The PES address is a possible duplicate with another PES address. Determine if the PES address is a housing unit and if the addresses on the PES list are the same.	Yes	Yes
<b>NI/DI/DI</b>	PES Nonmatched/Two Duplicate PES Addresses	The PES listed an address that the census did not. The PES addresses are possible duplicates with other PES addresses. Determine if the PES address is a housing unit and if the addresses on the PES list are the same.	Yes	No
<b>P</b>	Possible PES-Census Match	The PES and census addresses are possible matches. Determine if the PES and census addresses are the same.	Yes	Yes
<b>P/DE</b>	Possible PES-Census Match/Duplicate Census Address	The PES and census addresses are possible matches. The census address is a possible duplicate with another census address. Determine if the PES and census addresses are the	Yes	Yes



Type	Title	Definition	Available in IHUFU	Used in IHUFU
		same and if the addresses on the census list are the same.		
<b>P/DE/DE</b>	Possible PES-Census Match/Two Duplicate Census Addresses	The PES and census addresses are possible matches. The census addresses are possible duplicates with other census addresses. Determine if the PES and census addresses are the same and if the addresses on the census list are the same.	Yes	Yes
<b>P/DI</b>	Possible PES-Census Match/Duplicate PES Address	The PES and census addresses are possible matches. The PES address is a possible duplicate with another PES addresses. Determine if the PES and census addresses are the same and if the addresses on the PES list are the same.	Yes	Yes
<b>P/DI/DI</b>	Possible PES-Census Match/Two Duplicate PES Addresses	The PES and census addresses are possible matches. The PES addresses are possible duplicates with other PES addresses. Determine if the PES and census addresses are the same and if the addresses on the PES list are the same.	Yes	Yes
<b>M*</b>	Unit Status Update	The PES and census addresses match, but the unit status was listed by PES as something other than occupied or vacant. Determine the unit status of the PES address.	Yes	Yes
<b>M*/DE</b>	Unit Status Update/Duplicate Census Address	The PES and census addresses match, but the unit status was listed by PES as something other than occupied or vacant. The census address is a possible duplicate with another census address.	Yes	Yes

Type	Title	Definition	Available in IHUFU	Used in IHUFU
		Determine the unit status of the PES address and if the addresses on the census list are the same.		
<b>M*/DI</b>	Unit Status Update/Duplicate PES Address	The PES and census addresses match, but the unit status was listed by PES as something other than occupied or vacant. The PES address is a possible duplicate with another PES address. Determine the unit status of the PES address and if the addresses on the PES list are the same.	Yes	Yes
<b>M*/DE/DE</b>	Unit Status Update/Two Duplicate Census Addresses	The PES and census addresses match, but the unit status was listed by PES as something other than occupied or vacant. The census addresses are possible duplicates with other census addresses. Determine the unit status of the PES address and if the addresses on the census list are the same.	Yes	No
<b>M*/DI/DI</b>	Unit Status Update/Two Duplicate PES Addresses	The PES and census addresses match, but the unit status was listed by PES as something other than occupied or vacant. The PES addresses are possible duplicates with other PES addresses. Determine the unit status of the PES address and if the addresses on the PES list are the same.	Yes	Yes
<b>M*SB</b>	Surrounding BCU Match	The PES and census addresses were matched, but the BCUs for the two addresses are different. Determine the correct BCU.	Yes	Yes

Type	Title	Definition	Available in IHUFU	Used in IHUFU
<b>M*SB/DE</b> <i>(Note: Will only occur in Final HUFU)</i>	Surrounding BCU Match/Duplicate Census Address	The PES and census addresses were matched, but the BCUs for the two addresses are different. The census address is a possible duplicate with another census address. Determine the correct BCU and if the addresses on the census list are the same.	No	Yes
<b>M*SB/DI</b>	Surrounding BCU Match/Duplicate PES Address	The PES and census addresses were matched, but the BCUs for the two addresses are different. The PES address is a possible duplicate with another PES address. Determine the correct BCU and if the addresses on the PES list are the same.	Yes	Yes
<b>M*SB/DE/DE</b> <i>(Note: Will only occur in Final HUFU)</i>	Surrounding BCU Match/Two Duplicate Census Addresses	The PES and census addresses were matched, but the BCUs for the two addresses are different. The census addresses are possible duplicates with other census addresses. Determine the correct BCU and if the addresses on the census list are the same.	No	Yes
<b>M*SB/DI/DI</b>	Surrounding BCU Match/Two Duplicate PES Addresses	The PES and census addresses were matched, but the BCUs for the two addresses are different. The PES addresses are possible duplicates with other PES addresses. Determine the correct BCU and if the addresses on the PES list are the same.	Yes	Yes
<b>M*USSB</b>	Unit Status Update and Surrounding BCU Match	The PES and census addresses were matched, but the unit status was listed by PES as	Yes	Yes

Type	Title	Definition	Available in IHUFU	Used in IHUFU
		something other than occupied or vacant and the BCUs for the two addresses are different. Determine the unit status and the correct BCU.		
<b>M*USSB/DI</b>	Unit Status Update and Surrounding BCU Match/Duplicate PES Address	The PES and census addresses were matched, but the unit status was listed by PES as something other than occupied or vacant and the BCUs for the two addresses are different. The PES address is a possible duplicate with another PES address. Determine the unit status, the correct BCU, and if the addresses on the PES list are the same.	Yes	Yes
<b>M*USSB/DI/DI</b>	Unit Status Update and Surrounding BCU Match/Two Duplicate PES Addresses	The PES and census addresses were matched, but the unit status was listed by PES as something other than occupied or vacant and the BCUs for the two addresses are different. The PES addresses are possible duplicates with other PES addresses. Determine the unit status, the correct BCU, and if the addresses on the PES list are the same.	Yes	No
<b>P*</b>	Unit Status Update/Possible PES-Census Match	The PES and census addresses are possible matches, and the unit status was listed by PES as something other than occupied or vacant. Determine if the addresses are the same and the unit status of the PES address.	Yes	Yes
<b>P*/DE</b>	Unit Status Update/Possible PES-Census	The PES and census addresses are possible matches, and the unit status was listed by PES as	Yes	Yes

Type	Title	Definition	Available in IHUFU	Used in IHUFU
	Match/Duplicate Census Address	something other than occupied or vacant. The census address is a possible duplicate with another census address. Determine if the addresses are the same, the unit status of the PES address, and if the addresses on the census list are the same.		
<b>P*/DI</b>	Unit Status Update/Possible PES-Census Match/Duplicate PES Address	The PES and census addresses are possible matches, and the unit status was listed by PES as something other than occupied or vacant. The PES address is a possible duplicate with another PES address. Determine if the addresses are the same, the unit status of the PES address and if the addresses on the PES list are the same.	Yes	No
<b>P*/DE/DE</b>	Unit Status Update/Possible PES-Census Match/Two Duplicate Census Addresses	The PES and census addresses are possible matches, and the unit status was listed by PES as something other than occupied or vacant. The census addresses are possible duplicates with other census addresses. Determine if the addresses are the same, the unit status of the PES address, and if the addresses on the census list are the same.	Yes	No
<b>P*/DI/DI</b>	Unit Status Update/Possible PES-Census Match/Two Duplicate PES Addresses	The PES and census addresses are possible matches, and the unit status was listed by PES as something other than occupied or vacant. The PES addresses are possible duplicates with other PES addresses.	Yes	No

Type	Title	Definition	Available in IHUFU	Used in IHUFU
		Determine if the addresses are the same, the unit status of the PES address, and if the addresses on the PES list are the same.		
<b>P*SB</b>	Surrounding BCU Match/Possible PES-Census Match	The PES and census addresses are possible matches, and the BCUs for the two addresses are different. Determine if the addresses are the same and the correct BCU.	Yes	Yes
<b>P*SB/DI</b>	Surrounding BCU Match/Possible PES-Census Match/Duplicate PES Address	The PES and census addresses are possible matches, and the BCUs for the two addresses are different. The PES address is a possible duplicate with another PES address. Determine if the addresses are the same, the correct BCU, and if the addresses on the PES list are the same	Yes	Yes
<b>P*SB/DI/DI</b>	Surrounding BCU Match/Possible PES-Census Match/Two Duplicate PES Addresses	The PES and census addresses are possible matches, and the BCUs for the two addresses are different. The PES addresses are possible duplicates with other PES addresses. Determine if the addresses are the same, the correct BCU, and if the addresses on the PES list are the same.	Yes	No
<b>P*USSB</b>	Unit Status Update and Surrounding BCU Match/Possible PES-Census Match	The PES and census addresses are possible matches, the unit status was listed by PES as something other than occupied or vacant, and the BCUs for the two addresses are different. Determine if the addresses are the same, the unit status, and the correct BCU.	Yes	Yes

Type	Title	Definition	Available in IHUFU	Used in IHUFU
<b>P*USSB/DI</b>	Unit Status Update and Surrounding BCU Match/Possible PES-Census Match/Duplicate PES Address	The PES and census addresses are possible matches, the unit status was listed by PES as something other than occupied or vacant, and the BCUs for the two addresses are different. The PES address is a possible duplicate with another PES address. Determine if the addresses are the same, the unit status, the correct BCU, and if the addresses on the PES list are the same.	Yes	No
<b>P*USSB/DI/DI</b>	Unit Status Update and Surrounding BCU Match/Possible PES-Census Match/Two Duplicate PES Addresses	The PES and census addresses are possible matches, the unit status was listed by PES as something other than occupied or vacant, and the BCUs for the two addresses are different. The PES addresses are possible duplicates with other PES addresses. Determine if the addresses are the same, the unit status, the correct BCU, and if the addresses on the PES list are the same.	Yes	No
<b>GQ or GQ*</b>	Group Quarters	PES listed the address as a housing unit, but census listed it as group quarters. Determine if the PES address is a housing unit or group quarters.	Yes	Yes
<b>GQ/DE</b> <i>(Note: GQ/DE forms were flagged by CMMU, but no forms were created for these addresses. Case</i>	Group Quarters/Duplicate Census Address	PES listed the address as a housing unit, but census listed it as group quarters. The Census address is a possible duplicate with another Census address. Determine if the PES address is a housing unit or group quarters.	No	No

Type	Title	Definition	Available in IHUFU	Used in IHUFU
forms for these form types were not designed.)				